



MAGT1 gene

magnesium transporter 1

Normal Function

The *MAGT1* gene provides instructions for making a protein called a magnesium transporter, which moves charged atoms (ions) of magnesium (Mg^{2+}) into certain immune system cells called T cells. T cells recognize foreign invaders, such as viruses, bacteria, and fungi, and are then turned on (activated) to attack these invaders in order to prevent infection and illness. Specifically, the magnesium transporter produced from the *MAGT1* gene is active in CD8+ T cells, which are especially important in controlling viral infections such as the Epstein-Barr virus (EBV). These cells normally take in magnesium when they detect a foreign invader, and the magnesium is involved in activating the T cell's response.

Researchers suggest that magnesium transport may also be involved in the production of another type of T cell called helper T cells (CD4+ T cells) in a gland called the thymus. CD4+ T cells direct and assist the functions of the immune system by influencing the activities of other immune system cells.

Health Conditions Related to Genetic Changes

X-linked immunodeficiency with magnesium defect, Epstein-Barr virus infection, and neoplasia

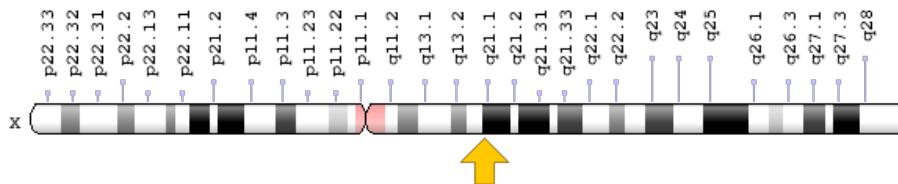
At least five *MAGT1* gene mutations that cause X-linked immunodeficiency with magnesium defect, Epstein-Barr virus infection, and neoplasia (typically known by the acronym XMEN) have been identified. XMEN is a disorder that affects the immune system in males. It involves chronic EBV infection and an increased risk of a cancer of immune system cells called lymphoma. The word "neoplasia" in the condition name refers to these lymphomas; neoplasia is a general term meaning abnormal growths of tissue.

MAGT1 gene mutations impair the magnesium transporter's function, reducing the amount of magnesium that gets into T cells. This magnesium deficiency prevents the efficient activation of the T cells to target EBV and other infections. Uncontrolled EBV infection increases the likelihood of developing lymphoma. Impaired production of CD4+ T cells resulting from abnormal magnesium transport likely accounts for the deficiency of this type of T cell in individuals with XMEN, contributing to the decreased ability to prevent infection and illness.

Chromosomal Location

Cytogenetic Location: Xq21.1, which is the long (q) arm of the X chromosome at position 21.1

Molecular Location: base pairs 77,826,364 to 77,895,568 on the X chromosome (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- bA217H1.1
- DKFZp564K142
- IAP
- implantation-associated protein
- magnesium transporter protein 1
- MRX95
- oligosaccharyltransferase 3 homolog B
- OST3B
- PRO0756
- XMEN

Additional Information & Resources

Educational Resources

- Medical Microbiology (fourth edition, 1996): Immunology Overview
<https://www.ncbi.nlm.nih.gov/books/NBK7795/>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28MAGT1%5BTIAB%5D%29+OR+%28%28XMEN%5BTIAB%5D%29+OR+%28implantation-associated+protein%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D>

OMIM

- MAGNESIUM TRANSPORTER 1
<http://omim.org/entry/300715>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_MAGT1.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=MAGT1%5Bgene%5D>
- HGNC Gene Family: Oligosaccharyltransferase complex subunits
<http://www.genenames.org/cgi-bin/genefamilies/set/445>
- HGNC Gene Family: X-linked mental retardation
<http://www.genenames.org/cgi-bin/genefamilies/set/103>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=28880
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/84061>
- UniProt
<http://www.uniprot.org/uniprot/Q9H0U3>

Sources for This Summary

- Brandao K, Deason-Towne F, Perraud AL, Schmitz C. The role of Mg²⁺ in immune cells. *Immunol Res.* 2013 Mar;55(1-3):261-9. doi: 10.1007/s12026-012-8371-x. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/22990458>
- Chaigne-Delalande B, Li FY, O'Connor GM, Lukacs MJ, Jiang P, Zheng L, Shatzer A, Biancalana M, Pittaluga S, Matthews HF, Jancel TJ, Bleesing JJ, Marsh RA, Kuijpers TW, Nichols KE, Lucas CL, Nagpal S, Mehmet H, Su HC, Cohen JI, Uzel G, Lenardo MJ. Mg²⁺ regulates cytotoxic functions of NK and CD8 T cells in chronic EBV infection through NKG2D. *Science.* 2013 Jul 12; 341(6142):186-91. doi: 10.1126/science.1240094.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/23846901>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3894782/>

- Li FY, Chaigne-Delalande B, Kanellopoulou C, Davis JC, Matthews HF, Douek DC, Cohen JI, Uzel G, Su HC, Lenardo MJ. Second messenger role for Mg²⁺ revealed by human T-cell immunodeficiency. *Nature*. 2011 Jul 27;475(7357):471-6. doi: 10.1038/nature10246.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/21796205>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3159560/>
- Li FY, Chaigne-Delalande B, Su H, Uzel G, Matthews H, Lenardo MJ. XMEN disease: a new primary immunodeficiency affecting Mg²⁺ regulation of immunity against Epstein-Barr virus. *Blood*. 2014 Apr 3;123(14):2148-52. doi: 10.1182/blood-2013-11-538686. Epub 2014 Feb 18. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24550228>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3975255/>
- Li FY, Lenardo MJ, Chaigne-Delalande B. Loss of MAGT1 abrogates the Mg²⁺ flux required for T cell signaling and leads to a novel human primary immunodeficiency. *Magnes Res*. 2011 Sep;24(3):S109-14. doi: 10.1684/mrh.2011.0286. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/21983175>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3732466/>
- OMIM: MAGNESIUM TRANSPORTER 1
<http://omim.org/entry/300715>
- Wolf FI, Trapani V. MagT1: a highly specific magnesium channel with important roles beyond cellular magnesium homeostasis. *Magnes Res*. 2011 Sep;24(3):S86-91. doi: 10.1684/mrh.2011.0288. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/21947671>

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